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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/563,105	12/30/2005	Misao Takakusaki	1592-0159PUS1	4561

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EXAMINER	
SONG, MATTHEW J	

ART UNIT	PAPER NUMBER
1792	

NOTIFICATION DATE	DELIVERY MODE
02/22/2010	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

mailroom@bskb.com

Office Action Summary	Application No.	Applicant(s)	
	10/563,105	TAKAKUSAKI ET AL.	
	Examiner	Art Unit	
	MATTHEW J. SONG	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 October 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-6* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *10/13/09; 1/21/2010*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Withdrawn Rejections

1. Applicant's arguments, see page 5 of the remarks filed 10/13/2009 with respect to the 35 USC 112 first paragraph rejection have been fully considered and are persuasive. The rejection of claims 1-6 has been withdrawn.

2. Applicant's arguments, see page 6 of the remarks filed 10/13/2009 with respect to the 35 USC 112 second paragraph rejection have been fully considered and are persuasive. The rejection of claims 1-6 has been withdrawn.

3. Applicant's arguments, see page 8 of the remarks, filed 10/13/2009, with respect to the rejection(s) of claim(s) 1-3 and 5 under 35 USC 103 in view of Kashima and Saito and the rejection of claims 4 and 6 in view of Kashima, Saito and Watanabe have been fully considered and are persuasive. Therefore, the rejections has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Yokogawa et al (US 2003/0141518).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person

> having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 1-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yokogawa et al (US 2003/0141518) in view of Kashima et al (JP 07-086162), an English Abstract and Computer Translation (CT) are provided.

Yokogawa et al teaches a High electron mobility transistor structure including a heterojunction comprising an InP substrate, an InAlAs layer **502**, an InGaAs layer **503**, an n-InAlAs layer **504** and an InP layer **505** serving as an etch stopping layer (para [0003], [0008] and [0048]). Yokogawa et al also teaches using MBE (para [0103]) and using source material beams of In, Al, and As to form InAlAs (para [0154]), which clearly suggests a first step of irradiating beams of at least one group III element and a molecular beam of a first group V element to form a first compound semiconductor layer. Yokogawa et al also teaches forming an InP layer epitaxial as an etching stopping layer (para [0160]), which clearly suggests supplying source beams of a group III element (In) and a group V element (P).

Yokogawa et al does not teach a second step of stopping the irradiation of the molecular beam of the group III element and the molecular beam of the first group V element and halting growth for period of time until a remaining molecular beam intensity of the first group V element is reduced to be in the range of 0.01 to 0.1 of that in the first step.

In a method of forming a heterostructure film, Kashima et al teaches supplying a group IIIa and Va material to grow a IIIaVa thin film using gas source molecular beam epitaxy (Abstract, Fig 1, and CT [0005]-[0007]), which clearly suggests a first step of irradiating a molecular beam of at least one group III element and a molecular beam of a first group V element to form a first compound semiconductor layer. Kashima et al also discloses supply to a substrate of a Va group material is suspended and t2 time discontinuation of the supply of all thin film raw materials to a substrate is carried out to terminate growth of the IIIaVa thin film (Abstract, Fig 1 and CT [0005]), this clearly suggests a second step of stopping the irradiation of the molecular beam of the group III element and the molecular beam of the first group V element because Kashima et al teaches a time period t2 where all raw materials are suspended (CT [0002]). Kashima et al also teaches supplying a Vb and IIIb material to grow a IIIbVb thin film after the time period t2. (Abstract and [0005]). Kashima et al also teaches forming a heterostructure of InGaAs and InP (CT [0007] and Fig 2, 4 and 5). Kashima et al also teaches source gases of As are efficiently exhausted in the growth vessel and filled up with the gas containing P (CT [0007]).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Yokogawa et al by stopping the flow of reactants for a sufficient period of time, as taught by Kashima et al, between layers of a heterojunction to control the deposition of

superfluous group V or Group III elements in the heterointerface, thereby forming a steep heterointerface (CT [0006]).

The combination of Yokogawa et al and Kashima et al does not explicitly teach halting growth for a period of time until the remaining molecular beam intensity of the first group V element is reduced to a range of 0.01 to 0.1 of that in the first step. Kashima et al teaches by adjusting supply downtime t_2, deposition of superfluous group Va element in a heterointerface is controlled and it is very steep (CT [0006]). Kashima et al also teaches a downtime was carried out for 24 seconds, which would be expected to reduce the remaining beam intensity to a range of 0.01 to 0.1 because applicant teaches stopping for 1 second reduced As beam intensity to about 1/14 and an As beam intensity within the claimed range after approximately 50 seconds (See applicant's pg 9 of the specification and applicant's Fig 4). Furthermore, Kashima et al teaches a supply downtime t2 to reduce superfluous group V element deposition in a heterointerface (CT [0006]), which clearly suggests residual group V element concentration is a result effective variable. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Yokogawa et al and Kashima et al by optimizing the residual group V element to obtain the claimed range by conducting routine experimentation thereby obtaining a steep heterointerface.

Referring to claims 3 and 5, the combination of Yokogawa et al and Kashima et al teaches a first semiconductor layer of InGaAs and a second semiconductor layer of InP ('518 para [0008] and [0160]).

Referring to claim 4 and 6, the combination of Yokogawa et al and Kashima et al teaches a first layer of InP **505** and a second layer of InAlAs **506** ('518 para [0008]). The combination of

Yokogawa et al and Kashima et al does not explicitly teach the second layer of InAlAs is an etch stopper layer, however the combination of Yokogawa et al and Kashima et al teaches the same material, InAlAs, as applicant (See applicant's claim 4 and 6); therefore clearly suggests an etch stopper layer.

Response to Arguments

6. Applicant's arguments with respect to claims 1-6 have been considered but are moot in view of the new ground(s) of rejection.

7. Applicant's arguments filed 10/13/2009 have been fully considered but they are not persuasive.

Applicant's argument regarding unexpected results for the claimed range of 0.1 to 0.01 is noted but not found persuasive. First, applicant has failed to show the criticality of the endpoint of 0.01. A high selectivity of etching rate for InP would also be expected with a As mixed amount of 0. Second, the Kashima et al reference clearly recognizes that the amount of superfluous group V element remaining affects the ability of obtaining a steep heterointerface (CT [0006]), thus the range would have been obvious to one of ordinary skill in the art to produce steep heterointerfaces.

Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to MATTHEW J. SONG whose telephone number is (571)272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Kornakov can be reached on 571-272-1303. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Matthew J Song
Examiner
Art Unit 1792

MJS
February 11, 2010
/Michael Kornakov/
Supervisory Patent Examiner, Art Unit 1792